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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/551,233 04/17/00 MATSUURA

K FUJ 99228 CI

EXAMINER

MM91/0122

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ART UNIT

PAPER NUMBER

2823

DATE MAILED:

01/22/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/551,233

Applicant(s)

Matsuura

Examiner

Hsien-Ming Lee

Group Art Unit

2823



- ☐ Responsive to communication(s) filed on _____
- ☐ This action is **FINAL**.
- ☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1035 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

- ☒ Claim(s) 1-20 _____ is/are pending in the application.
- Of the above, claim(s) _____ is/are withdrawn from consideration.
- ☐ Claim(s) _____ is/are allowed.
- ☒ Claim(s) 1-20 _____ is/are rejected.
- ☐ Claim(s) _____ is/are objected to.
- ☐ Claims _____ are subject to restriction or election requirement.

Application Papers

- ☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
- ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- ☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- ☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been
- ☐ received.
- ☐ received in Application No. (Series Code/Serial Number) _____.
- ☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

- ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- ☒ Notice of References Cited, PTO-892
- ☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 4
- ☐ Interview Summary, PTO-413
- ☐ Notice of Draftsperson's Patent Drawing Review, PTO-948
- ☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Drawings

1. New formal drawings are required in this application because figs. 5A-12 are too dark to show the surface morphology. Applicant is advised to employ the services of a competent patent draftsman outside the Office, as the Patent and Trademark Office no longer prepares new drawings.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 7 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

/ In claim 7, at lines 2-3, "said step of forming said step of forming said ferroelectric film" is confusing.

Claim Rejections - 35 USC § 103

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4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cuchiaro et al. (US 6,165,802) in view of Larson et al. (US 5,206,788).

Referring to figs. 1-5 and related text, Cuchiaro et al. teach the claimed method of fabricating a semiconductor device having a ferroelectric capacitor 118, comprising the steps of :

- * forming an active device element 110 on a substrate 102 (fig. 1);
- * forming an insulation film 114 over said substrate 102 to cover said active device element 110 (fig. 1);
- * forming a lower electrode layer 120 of said ferroelectric capacitor 118 over said insulation film 114, wherein said lower electrode layer includes depositing a Ti layer 116 and a Pt layer 120;
- * forming a ferroelectric film, such as PZT, 122, on said lower electrode 120 as a capacitor insulation film of said ferroelectric capacitor 118 (fig. 1);
- * crystallizing said ferroelectric film 122 by applying a rapid thermal annealing process in an atmosphere containing an oxidizing gas, such as oxygen, under a reduced total pressure smaller than an atmospheric pressure (col. 8, lines 20-30); and
- * forming an upper electrode layer 124 on said ferroelectric film 122 (fig. 1).

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Cuchiaro et al. do not teach said step of thermal annealing process is in an atmosphere containing a non-oxidizing gas besides an oxidizing gas. However, Larson et al. ('788), in a relevant method of forming ferroelectric capacitor, teach utilizing an annealing atmosphere containing oxygen-argon or oxygen-nitrogen for crystallizing ferroelectric film (col. 4, line 61 through col. 5, line 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate non-oxidizing gas such as argon or nitrogen with oxidizing gas such as oxygen for crystallizing ferroelectric film as taught by Larson, in Cuchiaro's method, since it would produce a satisfactory ferroelectric film for ferroelectric capacitor.

6. Claims 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Cuchiaro et al. ('802) and Larson et al. ('788) as applied to claims 1-14 above, and further in view of Perino et al. (US 5,426,075).

The combination of Cuchiaro et al. ('802) and Larson et al. ('788) substantially teaches the claimed semiconductor device except that ferroelectric film having a columnar microstructure substantially perpendicular to a principal surface of said lower electrode, and said ferroelectric film essentially consisting of crystal grains having a generally uniform grain diameter of less than about 200 nm. However, Perino et al. ('075) teach that as a ferroelectric film was subjected to crystallization annealing, the microstructure of ferroelectric film has a columnar microstructure oriented perpendicular to a surface of a substrate, and said ferroelectric film has crystal grains having a grain diameter of less than one micron (col. 11, lines 31-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to appreciate that the

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microstructure of ferroelectric film after crystallization annealing is a columnar microstructure oriented perpendicular to the surface of said lower electrode with a known-range diameter as taught by Perino et al., since such microstructure would be able to react to switching as external field is applied.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is (703) 305-7341. The examiner can normally be reached on Monday-Friday from 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy, can be reached on (703) 308-4918. The fax phone number for this Group is (703) 305-3432.

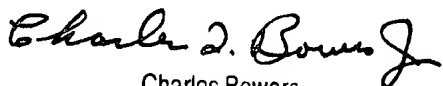
Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Hsien-Ming Lee

Examiner Group 2823

Jan. 16, 2001



Charles Bowers
Supervisory Patent Examiner
Technology Center 2800